CHBE 401 Syllabus

Transport Phenomena I
Fluid Mechanics
Fall Semester 2014

Section 001
T/Th 9:25-10:45am
Ryon 201

Section 002
T/Th 1-2:15pm
Ryon 201

DESCRIPTION:

This course provides an introduction to the basic fluid flow and conservation laws of transport phenomena including the principles and applications of fluid mechanics to chemical engineering problems. Topics include fluid statics, conservation of mass and momentum equations, microscopic and macroscopic balances, dimensional analysis and the applications of fluid flow in chemical engineering.

COURSE PREREQUISITE(S) AS LISTED IN THE GENERAL ANNOUNCEMENTS:

CHBE 301 and CHBE 305 and MATH 211 and (MATH 212 or MATH 222) and PHYS 101 and PHYS 102 or (PHYS 112 and PHYS 111)

INSTRUCTORS:

Section 001
Sibani Lisa Biswal
Abercrombie B240
Email: biswal@rice.edu
Phone: x6055
Office Hours: Thursday 11:00am – 1:00pm and by appointment

Section 002
Peng He
Abercrombie C125
Email: peng.he@rice.edu
Office Hours: Friday 1pm – 3:00pm and by appointment

TEACHING ASSISTANTS:

Robert Pinnick
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Chang Da
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TEXTBOOK:

Wilkes, James O., Fluid Mechanics for Chemical Engineers, 2nd ed., Prentice-Hall, 2006. ISBN # 978-0131482128.

OTHER USEFUL REFERENCES (RESERVED AT FONDREN)

1. Bird, R.B., Stewart, W.E, and Lightfoot, E.N., Transport Phenomena, 2nd ed., Wiley, 2002. ISBN # 978-0471410775.
2. Denn, M.M., Process Fluid Mechanics, Prentice-Hall, 1980. ISBN #978-0137231638.
3. Whitaker, S., Introduction to Fluid Mechanics, Krieger, 1992. ISBN #978-0894647857.

HOMEWORK/ EXAMINATION/ GRADING POLICY:

Homework 20%
Project 20%
Two Midterms 30%
-Scheduled for Oct 9th from 7-9pm
-Scheduled for Nov 13th from 7-9pm
Final 25%
Participation 5%

-A **50% penalty** will be assessed for **late** homework; no homework will be accepted once the solutions have been posted.
-You **may not** refer to previous years homework/solutions/exams.
-You may work with your classmates on homework sets but ultimately you must turn in your own work. You are NOT allowed to copy a classmate's homework directly ask or give your homework to a classmate to "consult".

HOMEWORK GUIDELINES:

-Homework must be submitted on 8.5"x11" paper
-All pages should be numbered, placed in chronological order, and contain your first and last name on the upper right side of the first page. Multiple pages should be secured by staple or paper clip and not folded.
− Homework should be neat and legible. Points may be taken off if the TAs cannot read your answers.
-Each solution should a list of assumptions, a diagram (if appropriate), and a solution containing adequate steps and explanations to ensure understanding of your solution by the instructor. The **final solutions to a homework problem must be boxed and include the correct units** or otherwise distinguished from the remainder of the problem. Solutions should be presented in a logical manner with commentary describing your process. No credit will be given if you only write down the final answer.
− Properly reference any material that you use and justify all assumptions clearly.

- Problems solved using a computer must contain all information required to reproduce your solution. Among other things, this means a spreadsheet printout only containing numbers is not sufficient. The formulas used must be included on the printout. All numbers must be identified and labeled with appropriate units. You must submit the data file for problems solved with computers by email in addition to submitting printouts and written work.

Homework and exam problems will be graded based on the following factors: correct assumptions, correct diagrams, legibility, clarity, neatness, identification of paper, clearly defined answer, correct approach to problem, and the correct answer.

HONOR CODE:

Academic dishonesty will not be tolerated. Failure to comply with the University's policy will result in an automatic "F" for CHBE 401.
**http://honor.rice.edu/index.cfm

WEB PAGE:

This course uses Owl Space. Please go to: http://owlspace-ccm.rice.edu/
The page includes:
Copies of problem sets and problem set solutions
Announcements
Your grades
Contact information

DISABILITY:

Any student with a documented disability needing academic adjustments or accommodations should speak with the instructors as soon as possible, preferably during the first two weeks of class. We will be happy to help you, and all communications will remain confidential.

As a reminder, you will also need to contact Disability Support Services in the Ley Student Center (www.dss.rice.edu). If you believe that you have an undocumented disability, you are encouraged to talk to the instructors and Disability Support Services so that you can get help.

COURSE OBJECTIVES:

Students will learn to:
1. Understand macroscopic and differential formulations of equations for conservation of mass, momentum, and mechanical energy.
2. Understand dimensional analysis and its use in developing correlations for friction factors and drag coefficients.
3. Apply the above concepts to determine flow rates, pressure drops, pumping power requirements, etc., in piping systems.
4. Derive ordinary differential equations for the velocity distribution in simple flows of Newtonian fluids and solve these equations subject to suitable boundary conditions.
5. Find sources of information on a topic of interest to them involving fluid mechanics and present a discussion of the topic both orally and in writing.

COURSE OUTCOMES:

Students will be able to
1. solve problems in fluid and interfacial statics including use of Archimedes' Principle.
2. solve problems using the macroscopic conservation equations and Bernoulli's equation.
3. solve problems of flow in piping systems using friction factors.
4. solve problems involving flow around immersed objects with application to solid/liquid separation processes and fluidized beds.
5. solve for velocity distributions in simple flows of Newtonian fluids and certain non-Newtonian fluids and in boundary layers.
6. improve literature search and communication skills.

CALENDAR:

<u>Typical Weekly Schedule:</u>
Class Lecture: T/Th – 9:25am to 10:40am
or T/Th – 1pm to 2:15pm
Class Recitation: W – 3 to 5pm
Biswal office hours: Th - 11am to 1pm
Homework Help Section: Th – 7 to 9pm
He office hours: F – 1pm to 3pm
Homework due: Friday 5pm